Hazard Elimination Project Evaluation

Project Log # 200608067

Hazard Elimination Project W-3419

Evaluation of the Intersection Realignment Affecting the Intersections of NC 403 at SR 1004 / SR 1501, NC 403 at SR 1558, and SR 1501 at SR 1558 in Duplin County

Documents Prepared By:

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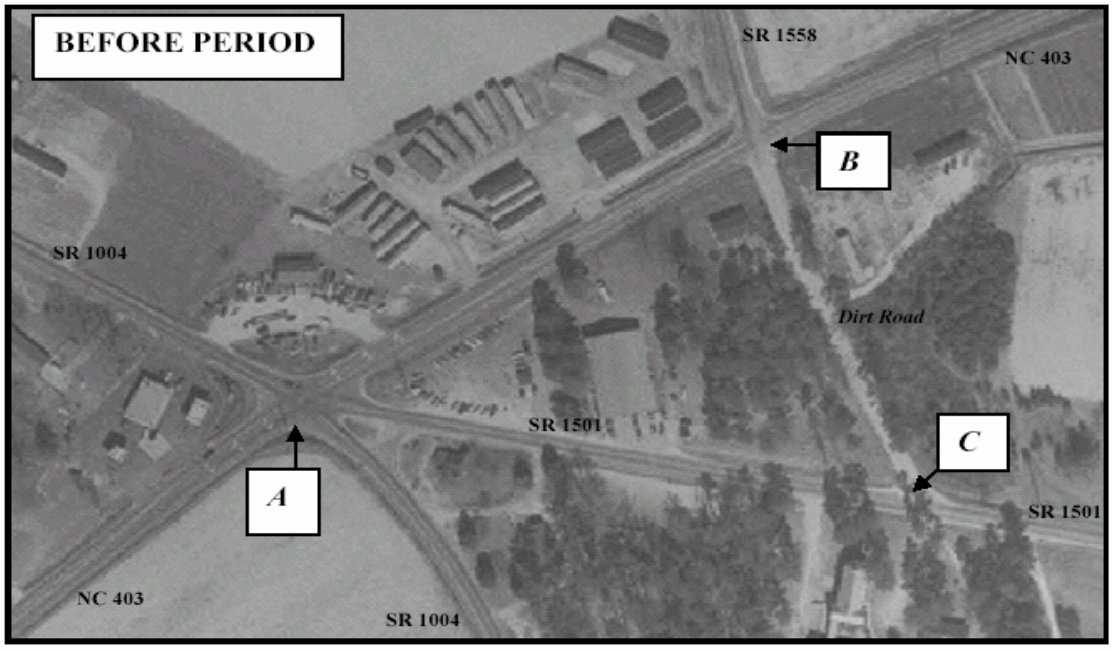
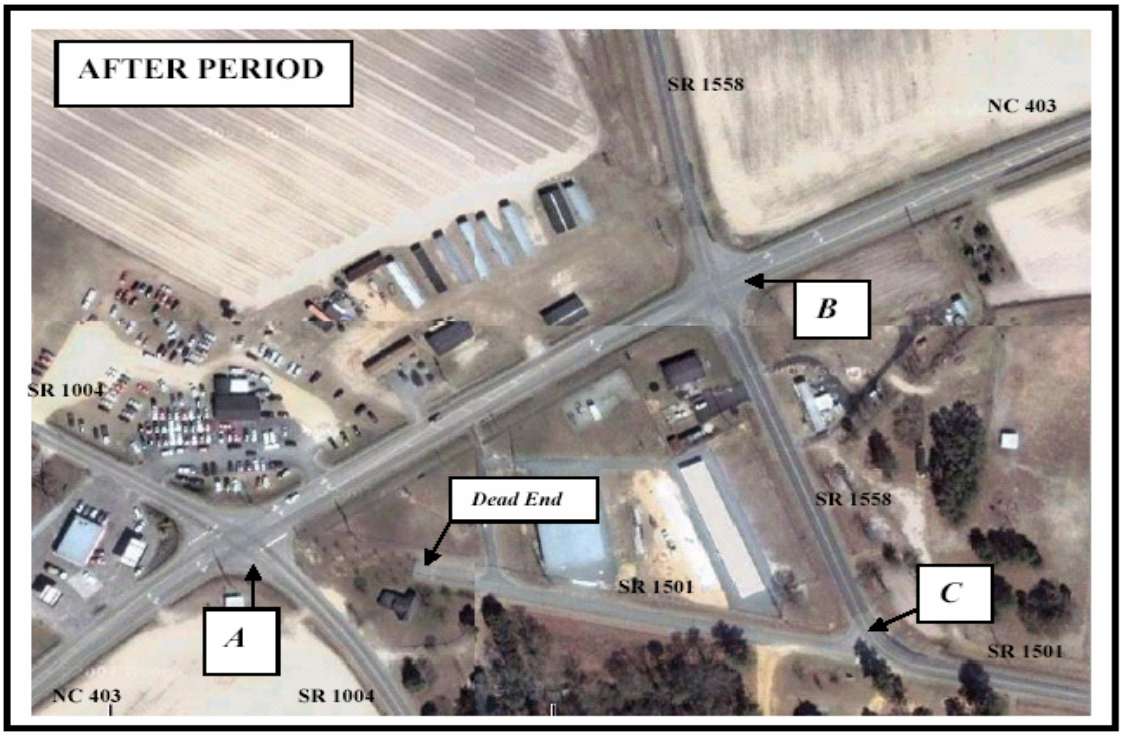
Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

SUBJECT LOCATION
Hazard Elimination Project W-3419 in Duplin County

The intersection realignment affected the existing intersections of NC 403 and SR 1004 / SR 1501 (Intersection A), NC 403 and SR 1558 (Intersection B), and created a new intersection of SR 1501 at SR 1558 (Intersection C). See the before and after period Aerial Photos below.





PROJECT INFORMATION

The safety countermeasure chosen for the subject location was the realignment of SR 1501 to intersect NC 403 opposite SR 1558 (Intersection B), in order to develop a conventional crossroad type design for the intersection of NC 403 and SR 1004 (Intersection A). Left turn lanes were also added on NC 403 at Intersection B as part of the project.

Intersections A, B, and C are stop sign controlled. Intersection A has an overhead actuated flasher and left turn lanes on NC 403. The speed limit is 55 mph on all approaches. There are two advisory speed limits, including a 40 mph advisory speed limit on NC 403 at Intersection B and a 15 mph advisory speed limit on SR 1558 / SR 1501 at Intersection C.

The final completion date for the improvement at the subject intersection was on July 14, 1999 with a total cost of $381,000.

NAÏVE BEFORE AND AFTER ANALYSIS

After reviewing the hazard elimination project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from May 1, 1999 through September 30, 1999. The before period consisted of reported crashes from May 1, 1991 through April 30, 1999 (8 years) and the after period consisted of reported crashes from October 1, 1999 through September 30, 2007 (8 years). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The following data tables depict the Naive Before and After Analysis for the treatment location. The Total Treatment Information includes all crashes within 150 feet of Intersections A, B, and C, and all crashes between the intersections (the entire area of influence). Data is also provided separately for Intersection A, Intersection B, and Intersection C. Please note that Target Crashes are all crashes at Intersection A that involve SR 1501 vehicles (because this is the leg that was removed) AND rear end crashes on NC 403 at Intersection B (because left turn lanes were added).

Treatment Information - Total	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	44	47	6.8%
Total Severity Index	10.04	9.30	-7.1%
Target Crashes	11	0	-100.0%
Target Crashes Severity Index	5.04	N/A	N/A
Volume	4400	5400	22.7%
Fatal Crashes	1	0	-100.0%
Non-Fatal Injury Crashes	25	25	0.0%
Total Injury Crashes	26	25	-3.8%
Night Crashes	9	10	11.1%
Wet Crashes	5	3	-40.0%
Alcohol / Drugs Involvement Crashes	2	4	100.0%

The naive before and after analysis resulted in a 7 percent increase in Total Crashes, a 100 percent decrease in Target Crashes, and a 23 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1995 and the after period ADT year was 2003.

Treatment Information – Intersection A: NC 403 at SR 1004	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	35	18	-48.6%
Total Severity Index	7.18	8.91	24.1%
Target Crashes	11	0	-100.0%
Target Crashes Severity Index	5.04	N/A	N/A
Volume	5100	4700	-7.8%
Fatal Crashes	0	0	N/A
Non-Fatal Injury Crashes	20	10	-50.0%
Total Injury Crashes	20	10	-50.0%
Night Crashes	8	3	-62.5%
Wet Crashes	3	2	-33.3%
Alcohol / Drugs Involvement Crashes	2	1	-50.0%

Intersection A experienced a 49 percent decrease in Total Crashes and a 100 percent decrease in Target Crashes.

Treatment Information – Intersection B: NC 403 at SR 1558	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	9	13	44.4%
Total Severity Index	21.13	6.12	-71.0%
Target Crashes	0	0	N/A
Volume	1900	3500	84.2%
Fatal Crashes	1	0	-100.0%
Non-Fatal Injury Crashes	5	9	80.0%
Total Injury Crashes	6	9	50.0%
Night Crashes	1	2	100.0%
Wet Crashes	2	1	-50.0%
Alcohol / Drugs Involvement Crashes	0	0	N/A

Intersection B experienced a 44 percent increase in Total Crashes.

Treatment Information – Intersection C: SR 1501 at SR 1558	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	0	11	N/A
Total Severity Index	0	16.80	N/A
Target Crashes	0	0	N/A
Volume	1800	2600	44.4%
Fatal Crashes	0	0	N/A
Non-Fatal Injury Crashes	0	5	N/A
Total Injury Crashes	0	5	N/A
Night Crashes	0	2	N/A
Wet Crashes	0	0	N/A
Alcohol / Drugs Involvement Crashes	0	2	N/A

Intersection C experienced an increase of 11 Total Crashes in the after period.

RESULTS AND DISCUSSION

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 7 percent increase in Total Crashes and a 100 percent decrease in Target Crashes when analyzing the entire area of influence. The Total Severity Index also decreased by 7 percent. The summary results above demonstrate that the treatment location appears to have had a slight increase in the number of Total Crashes after the realignment, and Target Crashes were eliminated.

The realignment of SR 1501 to intersect NC 403 opposite SR 1558 improved conditions at Intersection A, as intended. At Intersection A, the removal of SR 1501 resulted in a 49 percent decrease in Total Crashes, from 35 crashes in the before period to 18 crashes in the after period. The substantial crash reduction is due to the elimination of Target Crashes in the after period (crashes involving SR 1501 vehicles).

Although Intersection A experienced a crash reduction, the crash patterns migrated to Intersections B and C in the after period. Intersection B experienced a 44 percent increase in Total Crashes, from 9 crashes in the before period to 13 crashes in the after period. The number of Total Crashes at Intersection C increased from no crashes in the before period to 11 crashes in the after period.

The predominant crash types in both the before and after periods were Frontal Impact Crashes (including Left Turn-Same Roadway, Left Turn-Different Roadways, Right Turn-Same Roadway, Right Turn-Different Roadways, Head On, and Angle). Frontal Impact Crashes comprised over 80 percent of all crashes in both the before and after time periods, including 36 crashes in the before period and 38 crashes in the after period. These crash types migrated from Intersection A to Intersections B and C in the after period.

An area of particular concern is the pattern of Angle Crashes at Intersection C that developed in the after period. In all 8 of the Angle Crashes, the vehicles at fault were traveling westbound on SR 1501 at high speeds. There is a 15 mph advisory speed entering the curve, although vehicles at fault were traveling at 30 mph (2 vehicles), 40 mph (4 vehicles), 50 mph (1 vehicle), and over 70 mph (1 vehicle). It appears from the speeds and crash type that the vehicles at fault were attempting to travel straight onto the dead end road, colliding with southbound vehicles traveling through the curve. Two crashes involved drunk drivers at fault. Crashes at Intersection C did not dissipate within the first year after the new alignment. The pattern has persisted. There were 4 crashes in 2000, 2 crashes in 2002, 1 crash in 2005, and 4 crashes in 2006.

The curve at Intersection C is well marked, with advance horizontal alignment turn signs with 15-mph plaques, a chevron sign, a large arrow sign, a Dead End sign, and a Road Ends sign. Please see the attached *Treatment Site Photos* for photos of the signing at Intersection C.

The calculated benefit to cost ratio for this project is 0.01 considering total crashes. The benefit to cost ratio considering only target crashes is 0.43. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance costs.

As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of intersection.

TOTAL BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 403 at SR 1004/1501 and SR 1558 BY: CLS
COUNTY: Wake DATE: 4/24/2008
FILE NO.: W3419

DETAILED COST: TYPE IMPROVEMENT - Intersection Realignment

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$381,000	20	0.102	$38,806
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$381,000	20	0.102	$38,806

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $0
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $38,806
TOTAL COST OF PROJECT= $381,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	8.00	3	0.38	23	2.88	18	2.25	$262,600
AFTER	8.00	3	0.38	22	2.75	22	2.75	$262,275

Annual Benefits from Crash Cost Savings $325

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($38,481)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.01

TOTAL COST OF PROJECT - $381,000 COMPREHENSIVE B/C RATIO - 0.01

TARGET BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 403 at SR 1004/1501 and SR 1558 BY: CLS
COUNTY: Wake DATE: 4/24/2008
FILE NO.: W3419

DETAILED COST: TYPE IMPROVEMENT - Intersection Realignment

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$381,000	20	0.102	$38,806
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$381,000	20	0.102	$38,806

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $0
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $38,806
TOTAL COST OF PROJECT= $381,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	8.00	0	0.00	6	0.75	5	0.63	$16,813
AFTER	8.00	0	0.00	0	0.00	0	0.00	$0

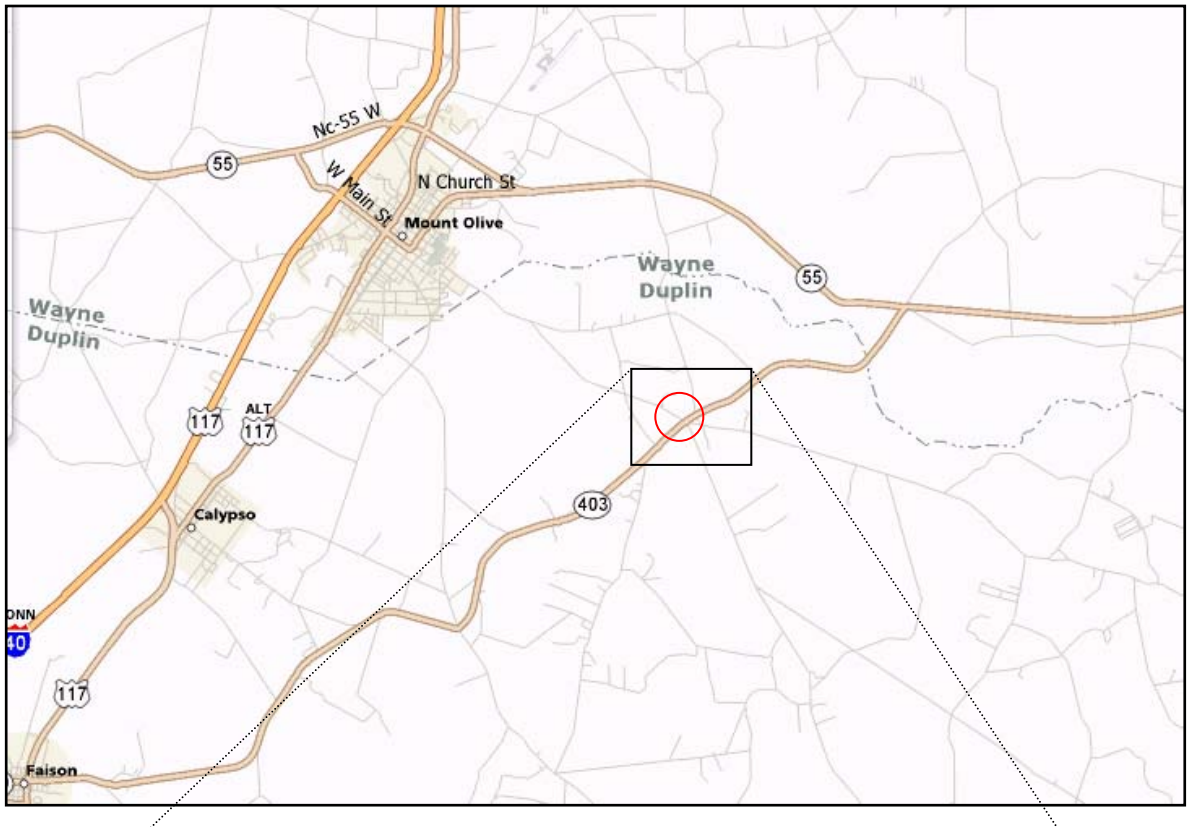
Annual Benefits from Crash Cost Savings $16,813

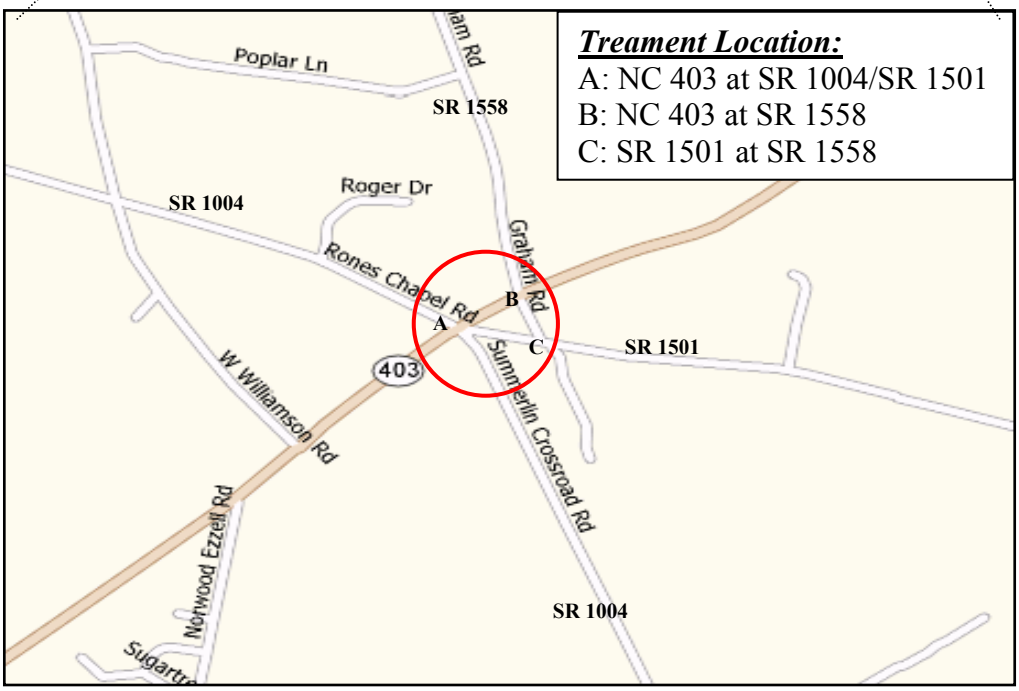
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($21,993)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.43

TOTAL COST OF PROJECT - $381,000 COMPREHENSIVE B/C RATIO - 0.43

LOCATION MAP – HAZARD ELIMINATION PROJECT W-3419





Treament Location:
A: NC 403 at SR 1004/SR 1501
B: NC 403 at SR 1558
C: SR 1501 at SR 1558

Treatment Location Photos (Taken on April 4, 2008)

Driving EB on NC 403 approaching intersection with SR 1004

Driving SB on SR 1004 approaching intersection with NC 403

Driving NB on SR 1004 approaching intersection with NC 403

Treatment Location Photos (Taken on April 4, 2008)

Driving EB on NC 403 approaching intersection with SR 1558

Driving WB on NC 403 approaching intersection with SR 1558

Driving NB on SR 1558 approaching intersection with NC 403

Treatment Location Photos (Taken on April 4, 2008)

Driving SB on SR 1558 approaching intersection with NC 403

Driving SB on SR 1558 approaching intersection with SR 1501

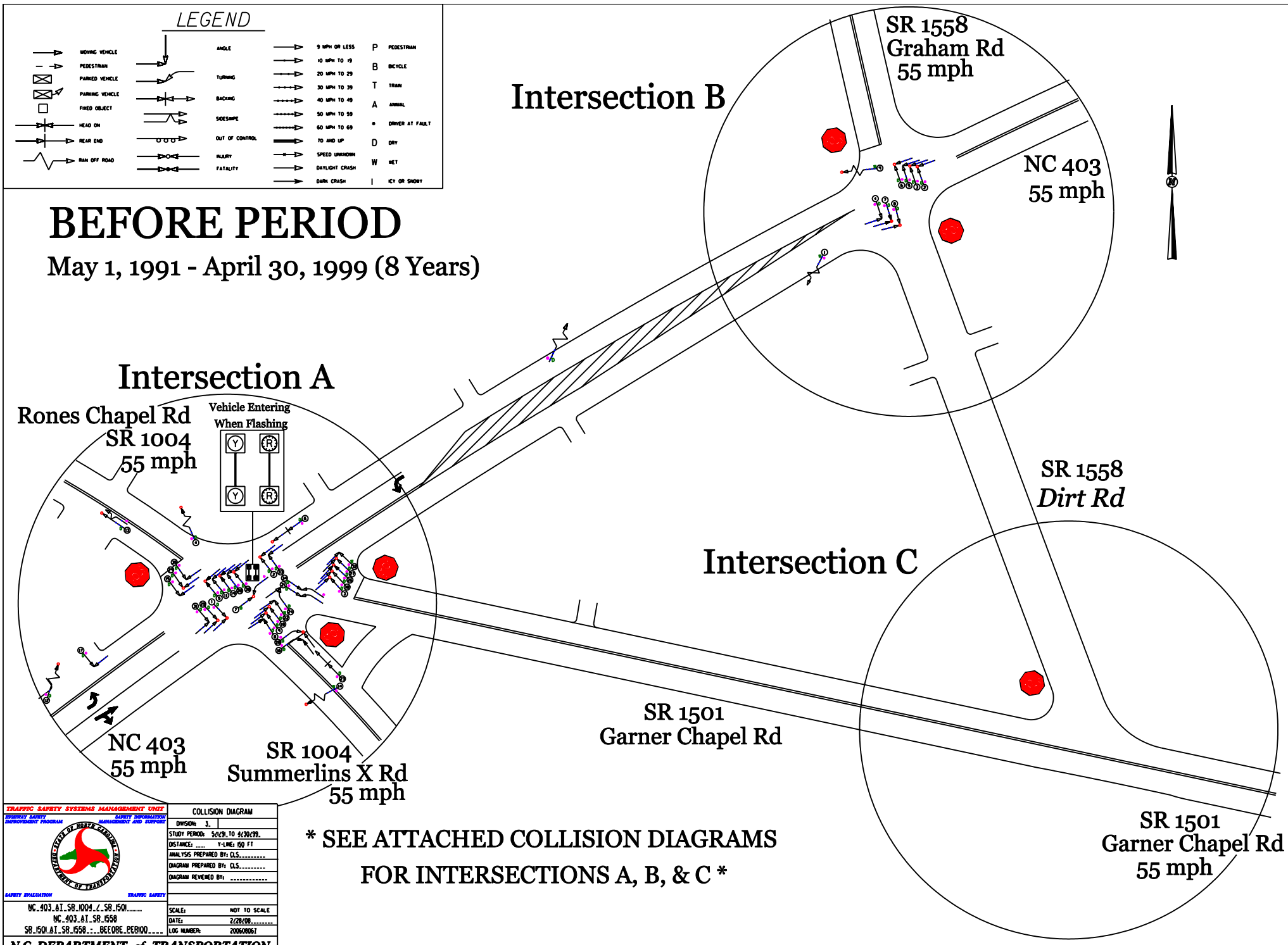
Driving EB on SR 1501 (Dead End) approaching intersection with SR 1558

Treatment Location Photos (Taken on April 4, 2008)

Driving WB on SR 1501 approaching intersection with SR 1558 & Dead End

BEFORE PERIOD

May 1, 1991 - April 30, 1999 (8 Years)



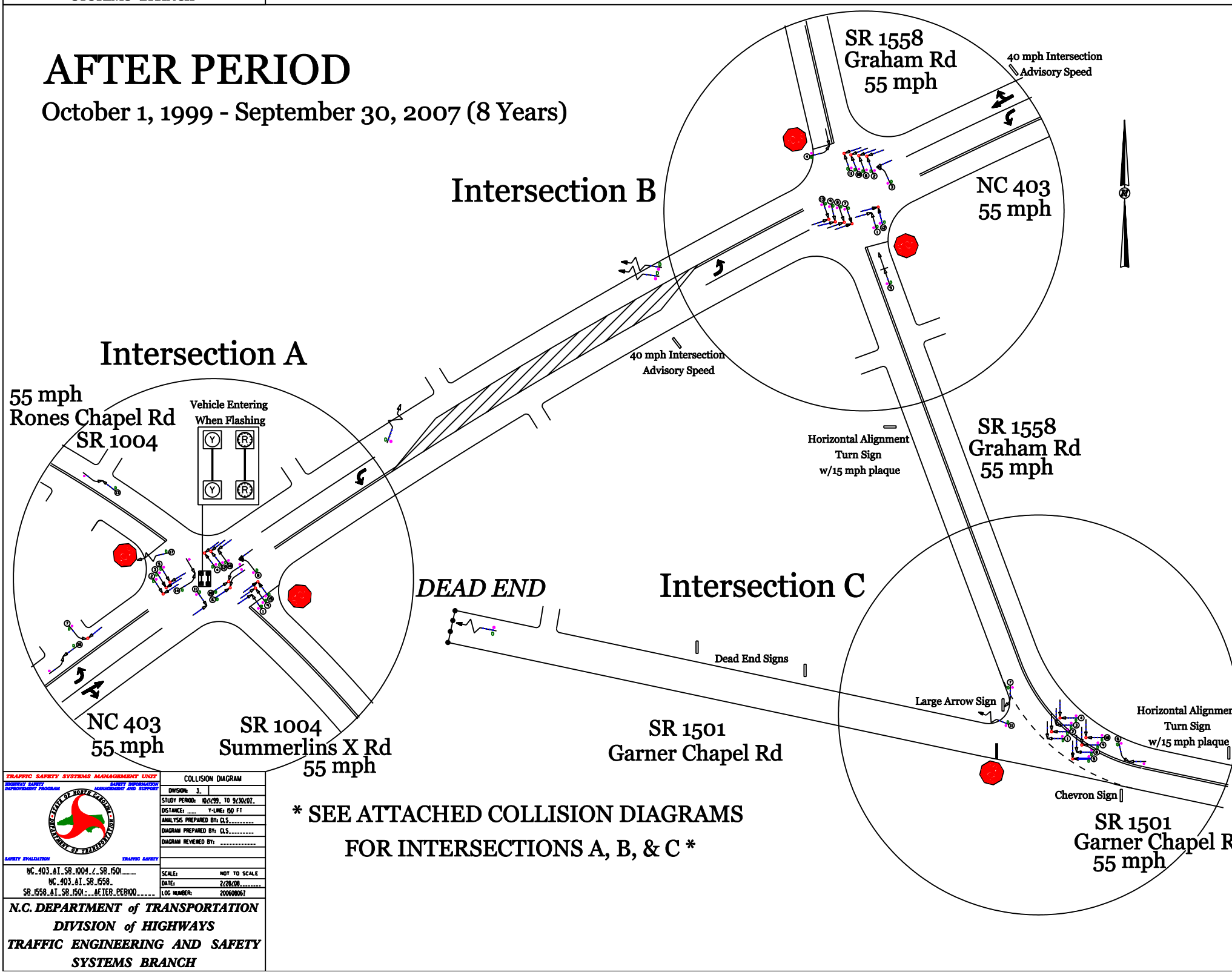
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT	COLLISION DIAGRAM
HIGHWAY SAFETY IMPROVEMENT PROGRAM / SAFETY INFORMATION MANAGEMENT AND SUPPORT	DIVISION: 3.
	STUDY PERIOD: 5/1/91 TO 4/30/99.
	DISTANCE: ..... Y-LINE: 150 FT
	ANALYSIS PREPARED BY: CLS.....
	DIAGRAM PREPARED BY: CLS.....
	DIAGRAM REVIEWED BY: .....
SAFETY EVALUATION / TRAFFIC SAFETY	
NC_403_AT_SR_1004_&_SR_1501..... NC_403_AT_SR_1558 SR_1501_AT_SR_1558_-_BEFORE_PER100____	SCALE: NOT TO SCALE DATE: 2/28/08..... LOG NUMBER: 20060807

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH

* SEE ATTACHED COLLISION DIAGRAMS FOR INTERSECTIONS A, B, & C *

AFTER PERIOD

October 1, 1999 - September 30, 2007 (8 Years)



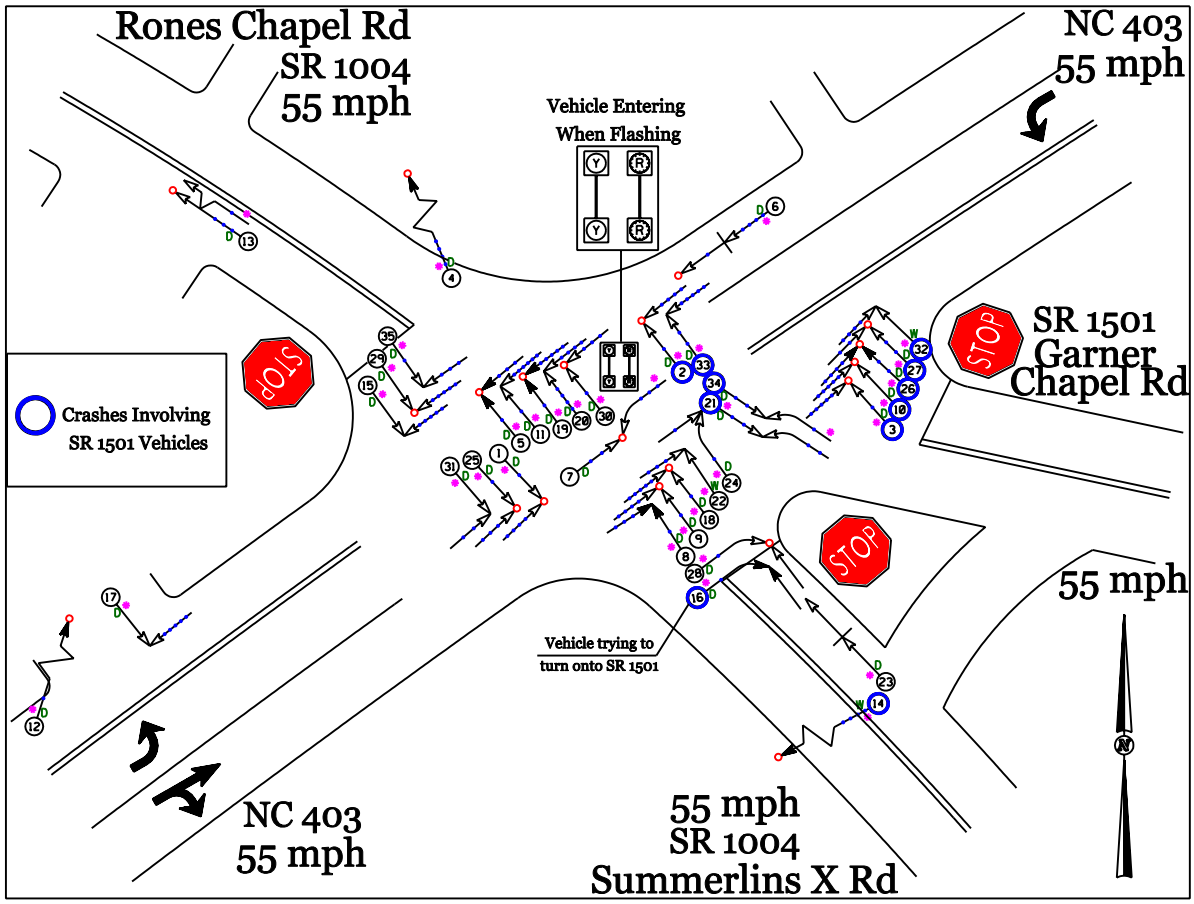
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT	COLLISION DIAGRAM
HIGHWAY SAFETY IMPROVEMENT PROGRAM / SAFETY INFORMATION MANAGEMENT AND SUPPORT	DIVISION: 3.
	STUDY PERIOD: 10/1/99. TO 9/30/07.
	DISTANCE: ..... Y-LINE: 150 FT
	ANALYSIS PREPARED BY: CLS.....
	DIAGRAM PREPARED BY: CLS.....
	DIAGRAM REVIEWED BY: .....
SAFETY EVALUATION / TRAFFIC SAFETY	
NC_403_AT_SR_1004_&_SR_1501..... NC_403_AT_SR_1558_ SR_1558_AT_SR_1501_-_AFTER_PER100_____	SCALE: NOT TO SCALE DATE: 2/28/08..... LOG NUMBER: 20060807

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH

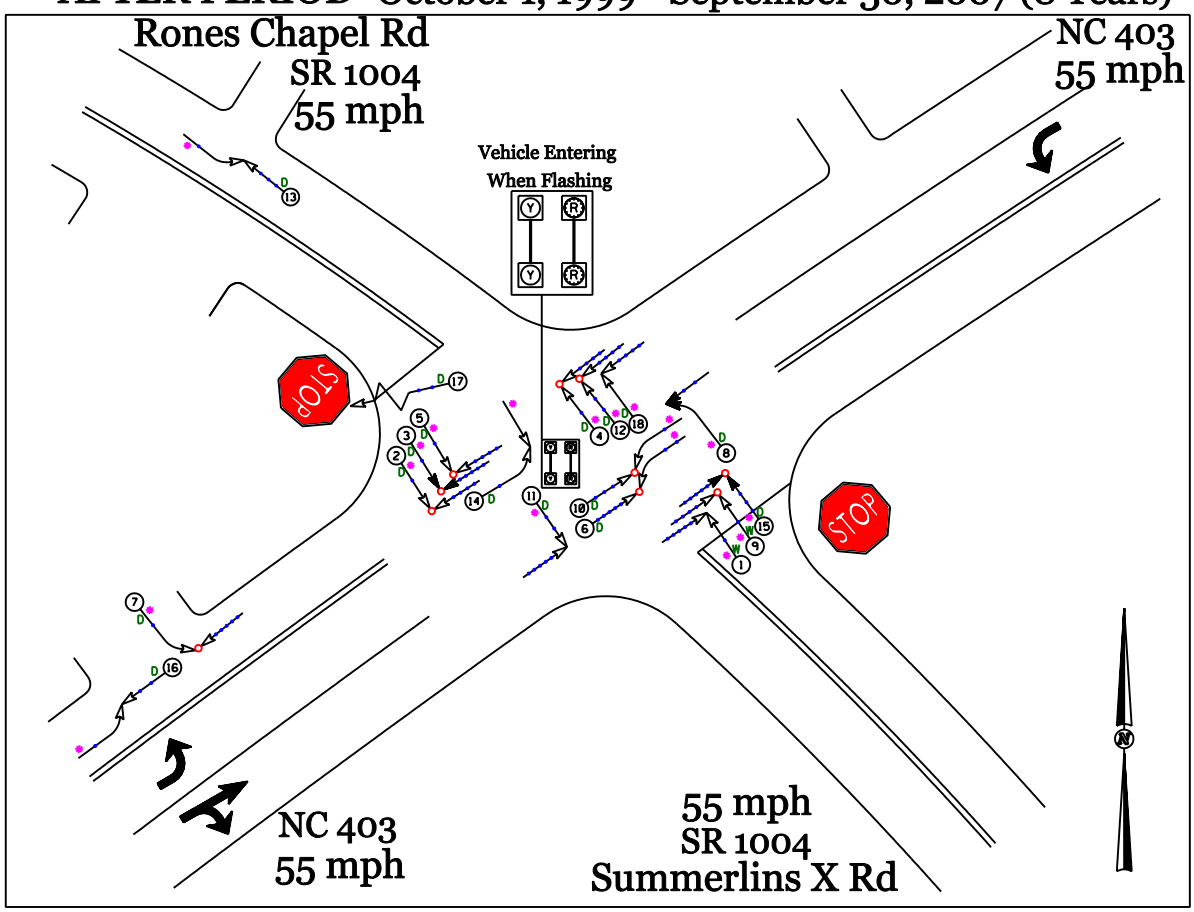
* SEE ATTACHED COLLISION DIAGRAMS FOR INTERSECTIONS A, B, & C *

INTERSECTION A

BEFORE PERIOD May 1, 1991 - April 30, 1999 (8 Years)

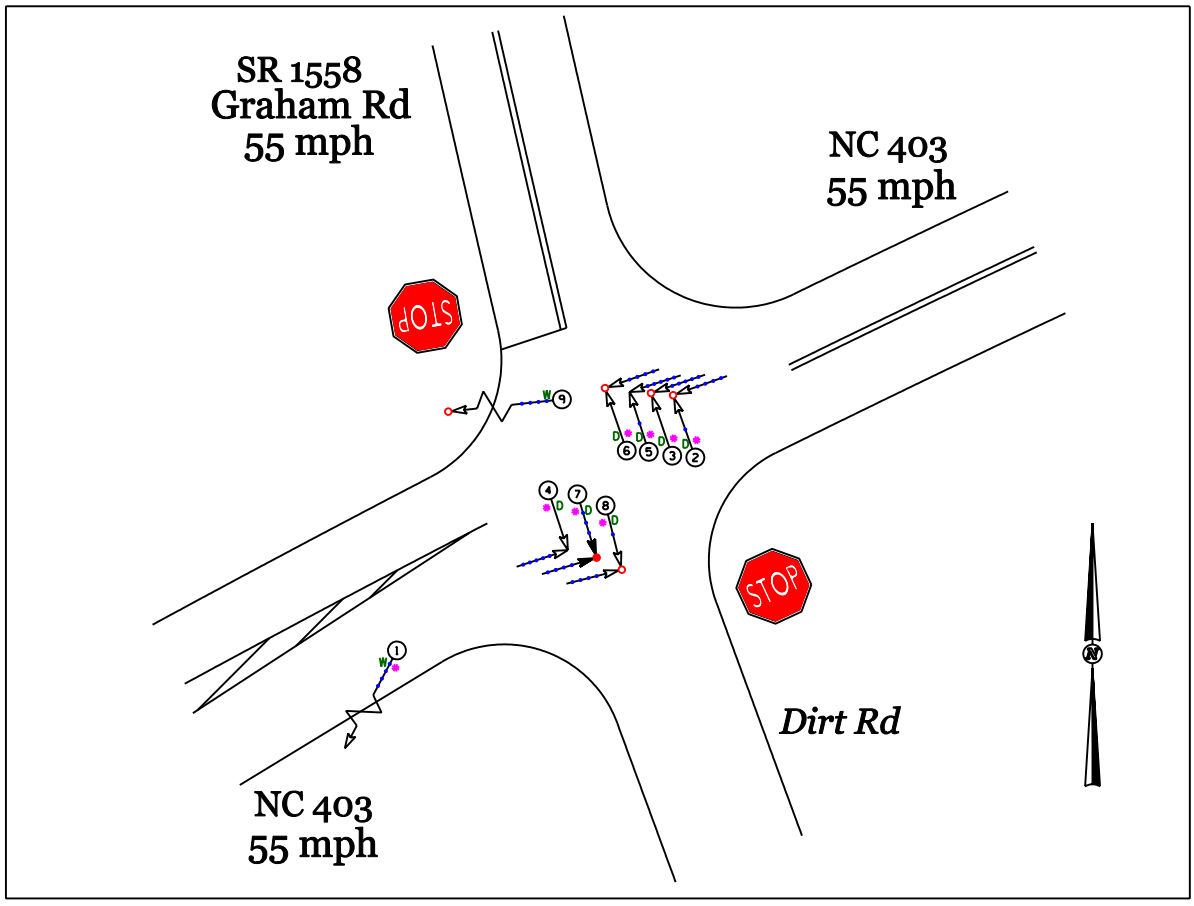


AFTER PERIOD October 1, 1999 - September 30, 2007 (8 Years)

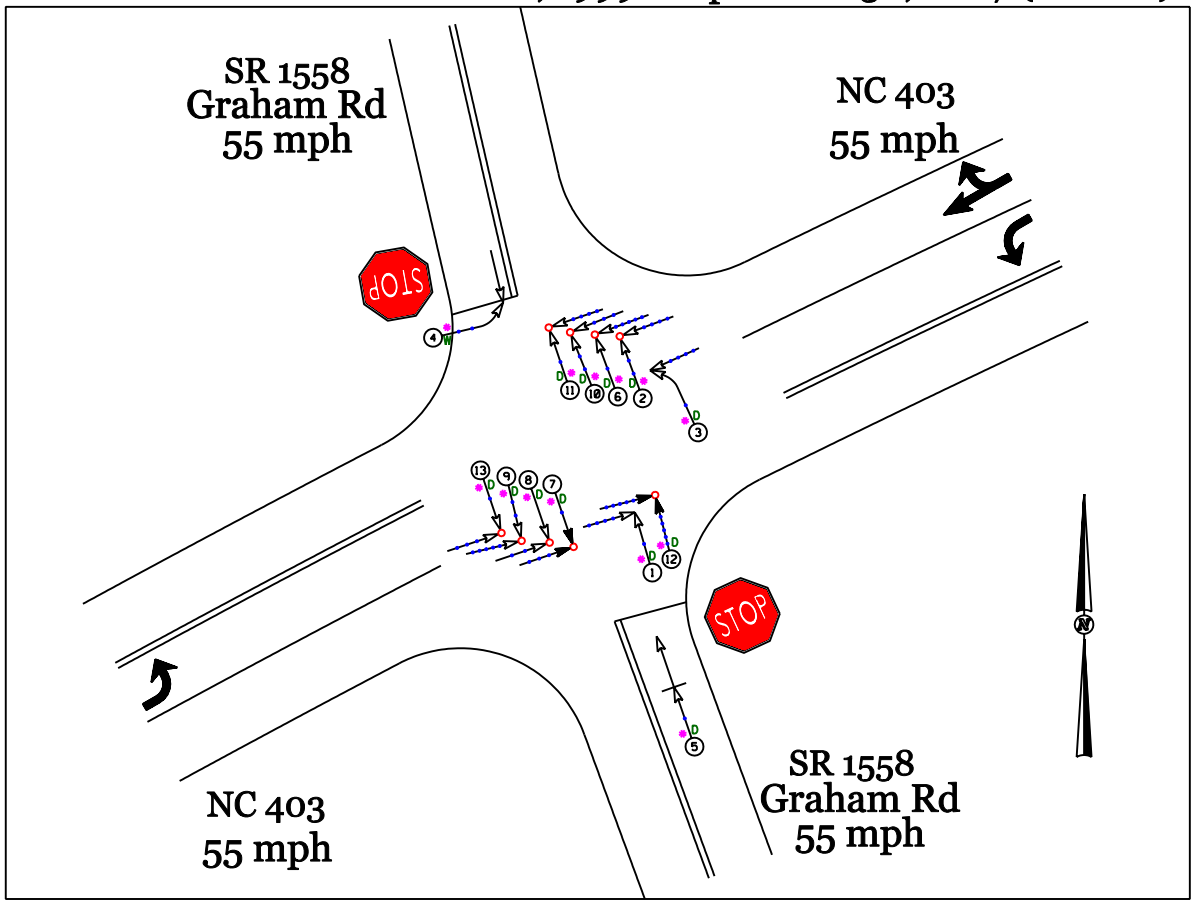


INTERSECTION B

BEFORE PERIOD May 1, 1991 - April 30, 1999 (8 Years)

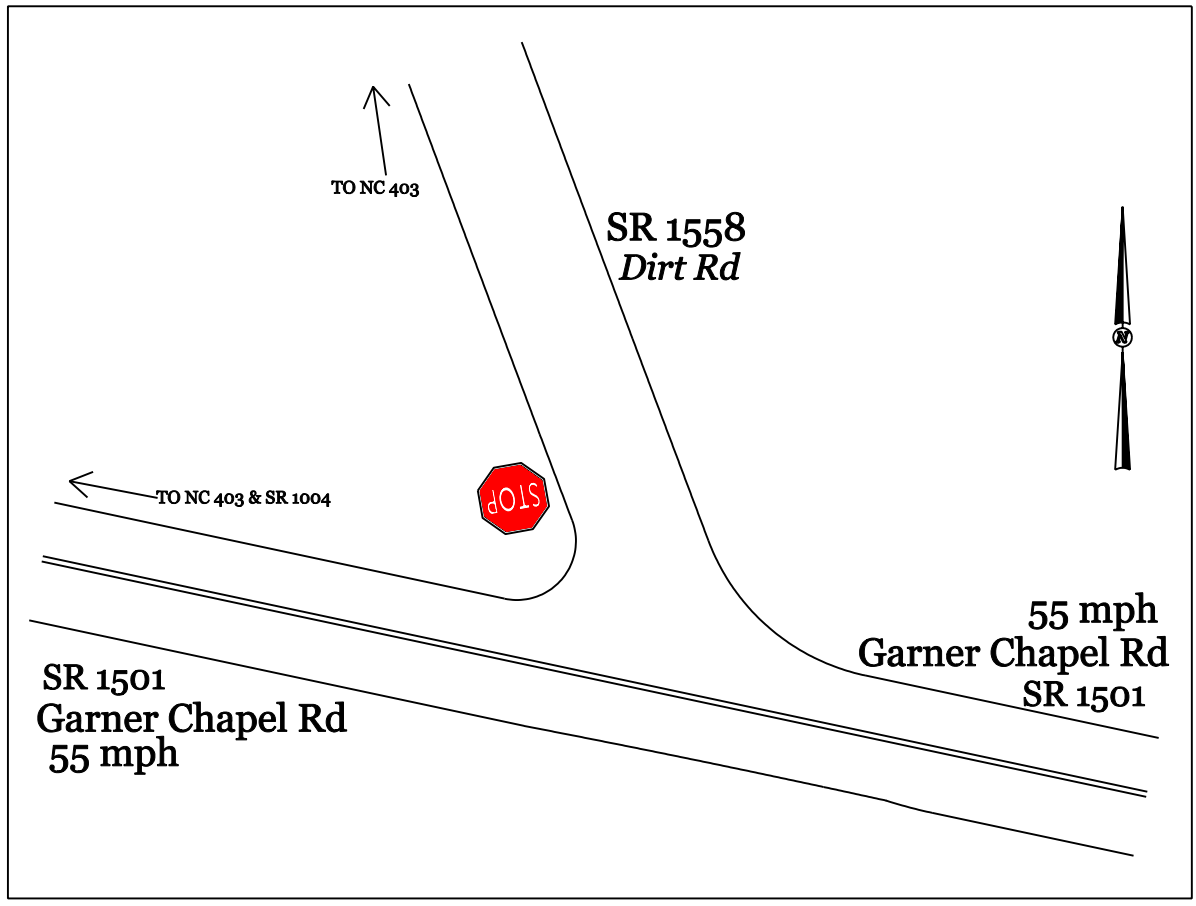


AFTER PERIOD October 1, 1999 - September 30, 2007 (8 Years)



INTERSECTION C

BEFORE PERIOD May 1, 1991 - April 30, 1999 (8 Years)



AFTER PERIOD October 1, 1999 - September 30, 2007 (8 Years)